CMR INSTITUTE OF TECHNOLOGY

Internal Assessment Test - II

Sub:	Machine Learning					Code:	22MBABA403
Date:	**19.09.2024**	Duration:	**90 minutes**	Max Marks: **50**	Sem: **IV**	Branch:	**MBA**

SET- II

	Marks	OBE	
		CO	RBT
Part A - Answer Any Two Full Questions (2* 20 = 40 marks)			
1 (a) **Associate k-means clustering as a hard clustering technique** K-means clustering is considered a hard clustering method because it assigns each point to exactly one cluster. In hard clustering, every data point is definitively placed a single cluster, with no overlap or uncertainty. Once the algorithm partitions the dat into k clusters, each point belongs to the cluster with the nearest centroid (the center of cluster), minimizing the within-cluster variance.	[03]	CO3	L2
(b) **Examine the Aggregation step in Bagging.** The aggregation step in bagging (Bootstrap Aggregating) refers to the process combining the predictions from multiple individual models (often decision tree to produce a final output. Bagging aims to improve model stability and accurac by reducing variance and mitigating the risk of overfitting. Here's how the aggregation step works depending on the type of problem: For Regression (Continuous Output): • The aggregation is done by taking the average of the predictions from a models. For Classification (Categorical Output): • The aggregation is done by majority voting. Purpose of Aggregation in Bagging: • Variance Reduction: By aggregating the predictions of multiple models trained on bootstrapped samples of the dataset, bagging helps reduce th variance and prevents the model from overfitting. • Robustness: Since the individual models may perform poorly on some parts of the dataset, combining their outputs usually leads to better over performance.	[07]	CO3	L3
(c) **Illustrate the process of AdaBoost** Steps in AdaBoost: **1**. Initialize Weights 2. Train Weak Classifier 3. Evaluate Classifier Error 4. Compute Classifier's Weight 5. Update Weights of Training Examples 6. Repeat 7. Final Classifier	[10]	CO3	L3

2. a. What is hypotheses space in ML

In Machine Learning (ML), the hypothesis space refers to the set of all possible models or functions that the learning algorithm can choose from to explain or predict the data. Each individual model within this space is called a hypothesis.

b. Explain the Expectation – Maximization algorithm

The Expectation-Maximization (EM) algorithm is an iterative optimization method used to find maximum likelihood estimates of parameters in statistical models, particularly when dealing with data that has missing or hidden variables. It alternates between two steps: the Expectation (E-step) and the Maximization (M-step), and is particularly useful for models with latent variables (unobserved data), such as in Gaussian Mixture Models (GMMs) or Hidden Markov Models (HMMs).

Key steps in E-M can be explained.

c. Analyze Random Forest algorithm as an ensembling technique

Random Forest is an ensemble learning method primarily used for classification and regression tasks. It operates by constructing a multitude of decision trees during training and outputting either the mode of the classes (for classification) or the average prediction (for regression) of the individual trees.

Key Concepts of Random Forest:
1. Decision Trees:
   - A decision tree is a flowchart-like model that splits the data based on feature values to make predictions.
   - Each tree in Random Forest is a weak learner, meaning it might not perform well on its own but is valuable when combined with others.
2. Ensemble Method:
   - Random Forest is an ensemble method that combines multiple decision trees to create a stronger, more accurate model.
   - It uses a process called bagging (Bootstrap Aggregating), where multiple trees are trained on random subsets of the data and features.

3.a. What do you mean by binomial distribution?

The binomial distribution is a discrete probability distribution that models the number of successes in a fixed number of independent Bernoulli trials, each of which has only two possible outcomes: success or failure. It is characterized by two parameters: the number of trials n and the probability of success in a single trial p.

b. Explain Q-learning with an example

Q-learning is a popular model-free reinforcement learning algorithm that allows an agent to learn how to act optimally in an environment by interacting with it and receiving rewards. The goal of Q-learning is to learn the Q-values (action-value function) that tell the agent the expected utility of taking a specific action in a given state.

Example Scenario: Gridworld

Let's walk through an example of Q-learning in a simple Gridworld environment:

Setup:
- Imagine an agent placed in a 4×4 \times 44×4 grid. The agent's task is to reach a goal state while avoiding a trap state.

[03]	CO1	L1
[07]	CO3	L3
[10]	CO3	L4
[03]	CO1	L1
[07]	CO3	L3

- The agent can move in four directions: up, down, left, right.
- The agent receives a reward of:
  - $+10+10+10$ for reaching the goal state.
  - $-10-10-10$ for falling into the trap state.
  - 000 for every other move (i.e., neutral reward).

C. Illustrate the visualization techniques for AR [10]	CO4	L3

Augmented Reality (AR) involves overlaying digital content on the real world, enhancing the user's experience. AR has seen widespread use in gaming, education, healthcare, and industry. The core challenge in AR is to align virtual content with the physical environment in real-time, which requires several underlying techniques. Below are some of the key techniques used in AR:
*Marker-based AR (Image Recognition)
*Markerless AR (Location-based AR)
*SLAM (Simultaneous Localization and Mapping)
* Interaction-based AR (Gesture Recognition)
* Superimposition-based AR

Part B - Compulsory (01*10=10 marks) – CASE STUDY
4.Read the following Case and answer appropriately
Ikea launched "IKEA place" an Augmented Reality (AR) application that lets people to confidently experience, experiment and share how good design transforms any space, such as home, office, school or studio. From sofas, arm chairs to coffee tables, all the products in IKEA Place are 3D and true to scale so that every choice is just the right size, design and function. Built on Apple's new ARKit technology, IKEA place makes customers ' buying decision easy from their own place at the swipe of finger, and it is a total game changer for retail.
Evaluate contribution of AR model from the perspective of retail profitability

a. **Evaluate contribution of AR model from the perspective of retail profitability** [5] CO2 L5

In the retail industry, Augmented Reality (AR) is increasingly being adopted to improve customer experiences, engagement, and ultimately profitability. AR models can help retailers by influencing buying decisions, improving product visualization, and streamlining operations. Below are some of the ways AR models can boost retail profitability:

b. **Determine the AR implementation challenges** [5] CO2 L3
Technical Limitations
- Hardware Constraints:
- Software Development:
- Integration with Existing Systems:

User Experience (UX) Challenges
- Complexity and Usability:
- Overwhelming Information:
- Device Dependence:

	Course Outcomes (COs)	PO1	PO2	PO3	PO4	PO5	PSO1	PSO2	PSO3	PSO4
CO1:	Understand the concepts of Machine learning	2a,3a					2a,3a			
CO2:	Apply the knowledge of Data visualisation and accurate decision making		4a,4b					4a,4b		

CO3:	Analyse the Big data and pattern using machine learning algorithms	1a	1b,1c,2b,2c,3b			1a, b,1c,2b,2c,3b			
CO4:	Evaluate the Data Structure and provide immersive experience to users		3c			3c			
CO5:									
CO6:									

Cognitive level	KEYWORDS
L1 - Remember	list, define, tell, describe, recite, recall, identify, show, label, tabulate, quote, name, who, when, where, etc.
L2 - Understand	describe, explain, paraphrase, restate, associate, contrast, summarize, differentiate interpret, discuss
L3 - Apply	calculate, predict, apply, solve, illustrate, use, demonstrate, determine, model, experiment, show, examine, modify
L4 - Analyze	classify, outline, break down, categorize, analyze, diagram, illustrate, infer, select
L5 - Evaluate	asses, decide, choose, rank, grade, test, measure, defend, recommend, convince, select, judge, support, conclude, argue, justify, compare, summarize, evaluate
L6 - Create	design, formulate, build, invent, create, compose, generate, derive, modify, develop, integrate

PO1–*Theoretical Knowledge;* **PO2**–*Foster Analytical and Critical Thinking Abilities for data based decision making;*
PO3– *Develop Value Based Leadership;* **PO4** –*Ability to Understand and communicate various business aspects to global;*
PO5 – *Ability to lead themselves and others in the achievement of organizational goals contributing effectively to a team environment;*
PSO1- *Comprehend Contemporary features of Business Management Science and its administration*
PSO2- *Analyze and interpret the dynamic situations for making Business Management strategies*
PSO3- *Handle responsibility with the ethical values for all actions undertaken by them*
PSO4- *Adapt and focus on achieving the organizational goal and objectives with complete zeal and commitment.*

CI   **CCI**   **HOD**